Podcasting in nursing and midwifery education

Title

Podcasting in nursing and midwifery education: An integrative review

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Abstract

Podcasting is used in higher education so various digital resources can be shared with students. This review aims to synthesise evidence on podcasting in nursing and midwifery education. PubMed, MEDLINE, CINAHL, Scopus and ERIC databases were searched using key terms. 242 articles were found and screened. Data extraction, quality assessment and data analysis, underpinned by a Social Media Learning Model, were conducted on relevant studies. Twenty-six studies were included in the review. Three themes emerged; 1) learning and other outcomes, 2) antecedents to learning, and 3) learning process. Students seemed to acquire new knowledge and skills by using podcasts and it also appeared to improve clinical confidence. The organisation of podcasting, digital literacy and e-Professionalism, the personal motivation of learners, and flexible access to the technology seemed to impact the delivery of this educational intervention. Mechanisms that appeared to affect the learning process were the speed of exchange, the type of social media user, the timeframe, quality of information, the functionality of podcasts and other learning activities. This review synthesised evidence on podcasting in nursing and midwifery education. The technology was seen as a positive learning tool but more robust research examining its efficacy in improving learning outcomes is needed.

Citation

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Background

Nursing and midwifery education have undergone numerous changes over the preceding decades, with a move towards more student-centred learning, teaching and assessment across a range of academic and clinical environments. Technological advances such as personal computing, the Internet and mobile devices have helped shape the direction of higher and continuing education. They have enabled educators to design and deliver interactive, instructive content that is accessible almost anytime, anywhere (O'Connor et al., 2020). Hence, these electronic tools support distance learning throughout students and practitioner's professional development and provide platforms for collaborative learning communities that can create and share educational resources (Sinclair et al., 2016). However, the volume and pace of technological change has resulted in a plethora of software applications and hardware devices, making it complicated for both educators and students to choose those most appropriate and beneficial for learning.

A host of different technologies are being used in nursing and midwifery education. Virtual learning environments such as Blackboard, Moodle, Sakai, Canvas, and Desire2Learn (Brightspace) are popular among education providers as they offer numerous functions such as curriculum mapping, electronic communication (discussion forums, chat, email), online support, student analytics and weblinks to external resources within an integrated platform (Hart et al., 2019). They are considered to be proprietary learning management systems and should have copyright designation. Nursing and midwifery educators have also explored other technologies that can support student learning including an array of hand-held devices like personal digital assistants and tablet computers (O'Connor and Andrews, 2015), smartphones and mobile applications (O'Connor and Andrews, 2018), and social media (Duke et al., 2017). These tools have become increasingly popularised within various

educational settings and can allow students flexible forms of learning that suit their personal lifestyles and meet the demands of university education or working in diverse clinical environments from acute hospital, to community and home settings.

Podcasting is one such technology that is widely used due to the ease with which digital audio, video or other recordings can be created and shared online and streamed or downloaded to a device for listening or viewing (Hargett, 2018). In nursing and midwifery education, podcasting has been employed as a pedagogical tool by educators in many countries to deliver teaching material by supplementing traditional face-to-face lectures with audio-visual content (Strickland et al., 2012). This type of digital delivery mechanism enables information to be more accessible by offering remote access online. Students can subscribe to web services to stream podcasts or download files to a mobile device or desktop computer. Podcasting is becoming a viable education solution for many nursing and midwifery students, who are predominantly a new generation with diverse digital literacy skills and desire methods to engage with curricula that are interactive and learner centred.

Podcasting first appeared in the nursing education literature in 2006 when nurse educators in the United States discussed how this technology could be used to improve learning (Maag, 2006). This mirrors discussions of podcasting as a useful electronic learning tool in other forms of health professional education such as medicine (Boulos et al., 2006). It can be used to support a number of different learning preferences such as self-directed and peer-to-peer learning (Button et al., 2014) and can be disseminated through numerous online channels, in particular social media. Despite the abundance of pedagogic literature exploring the subject of podcasting in nursing and midwifery education, no synthesis of the evidence examining its use has yet been undertaken.

Aims

Hence, the aim of this integrative review is to identify and synthesise literature on podcasting in nursing and midwifery education. The review questions are:

• What effect do podcasts have on learning in nursing and midwifery education?

• What are the perspectives of nursing and midwifery educators, students and practice staff towards using podcasting for learning?

The review is necessary to provide evidence to educators and students regarding the potential benefits this form of eLearning can provide in terms of learning outcomes and resource investment. The review will also pinpoint knowledge gaps for future research and provide recommendations on how to employ podcasting for teaching, learning and assessment across a range of settings.

Methods

As the literature on podcasting could have included quantitative, qualitative and mixed-method designs, an integrative review approach was needed. This allowed for the inclusion of a broad range of studies that employed different methodological approaches to be synthesised in a systematic way. The integrative review followed the five stages described by (Whittemore and Knafl, 2005).

Stage 1 and 2: Problem Identification and Literature Search A search strategy was developed and a combination of free text keywords and Medical Subject Heading (MeSH) terms for the review population, intervention and outcome were used (see Appendix A). A systematic search was conducted using five online bibliographical databases; PubMed Central, MEDLINE (Ovid), CINAHL (EBSCOHost), Scopus and ERIC. The search was

originally undertaken in June 2016. An update was performed in January 2018 and January 2019. Reference tracking and hand searching a number of nursing and midwifery education journals was also conducted. Mendeley software was used to manage results and remove duplicate citations.

The inclusion criteria for the review were studies with the following attributes. Firstly, they had to contain participants who were nurses or midwives or students undertaking pre-registration training in these disciplines. Studies were excluded if participants were other types of health professionals or mixed groups where nurses, midwives or students of these two professions were not clearly identifiable. Secondly, podcasting had to be used as an educational tool. Studies exploring a mixture of educational technologies where podcasting was not a distinct component, those using podcasts or audio recorded stories on a one-off basis, digital resources that were not accessible online or studies examining digital audio feedback were also excluded. Thirdly, studies must have undertaken empirical research, be published in an English language, peer-reviewed journal and have outcomes related to learning. No publication dates were stipulated in the inclusion criteria due to the recent emergence of podcasting as an educational technology. Finally, literature reviews, discussion or opinion articles, theses and conference proceedings were omitted. Screening was undertaken by two members of the research team working independently. Titles and abstracts were assessed against the inclusion criteria for relevance to the review questions and those that did not meet the inclusion criteria were discarded. Then, full text screening took place and studies not aligned to the reviews' inclusion criteria were rejected. Any disagreements during the screening process were resolved through consensus discussion with a third team member.

Stage 3: Data Evaluation A number of Joanna Briggs Institute (JBI) critical appraisal

tools were used to determine the quality of each individual study (http://joannabriggs.org/research/critical-appraisal-tools.html) (see Appendix B). The assessment of quality was undertaken by two researchers working independently. Any disagreements were resolved through consensus discussion.

Stage 4: Data Analysis A constant comparative method was applied to convert extracted data into systematic categories that could be compared and contrasted, enabling an in-depth understanding of podcasting to emerge (Patton, 2002). The five stages of this analytical process were followed (see Fig. 1). Initially, the included studies were divided into sub-groups based on study design and analysed sequentially, beginning with qualitative studies, then mixed methods and lastly those with quasi-experimental or experimental designs. Data from each of the twenty-six included studies were extracted to create an initial matrix. The data included the author, year and country; research aim, theory and setting; methods such as ethical approval, study design, approaches to data collection and analysis; the type and number of participants; the kind of podcasting intervention such as the devices and software used; and key findings (see Table 1). The data display phase encompassed iterative rounds of qualitative coding using N-Vivo QSR 11, until a number of central concepts emerged. Next these concepts were compared and contrasted within sub-groups to determine overarching themes and relationships between them. In the next phase, themes and their relationships were analysed further to identify how different or cohesive they were in helping explain whether nurses, midwives or students of these professions learned via podcasting and how this process works.

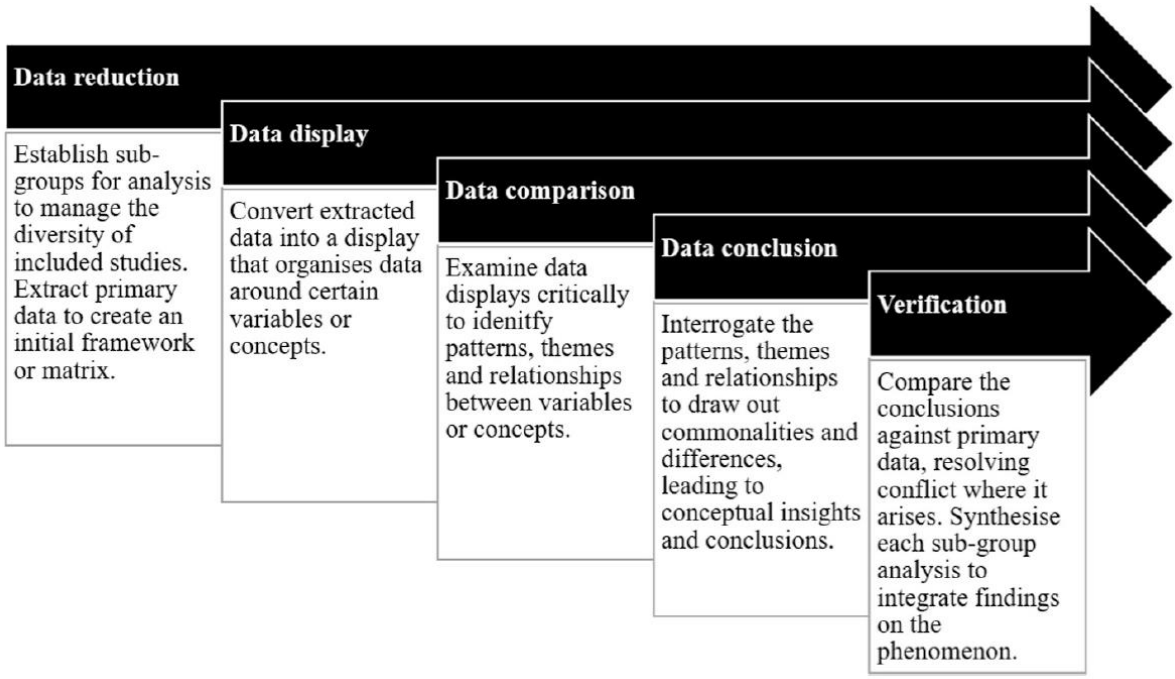

Fig. 1. Constant comparative approach.

Stage 5: Presentation Finally, verification involved using a Social Media Learning Model (SMLM) (O′ Connor, et al. 2018) to synthesise findings of the sub-group analysis and present an in-depth understanding of learning via podcasting. This learning model centres around three mechanisms; 1) the person, 2) environment, and 3) behaviour that are made up of a number of elements which interact with one another (see Appendix C). It was originally developed from a review of social networking applications, such as Facebook and Twitter, in nursing and midwifery education using Bandura's (Bandura, 1977) Social Learning Theory. Hence, it was appropriate to use in this review to undertake the integration and synthesis of the findings on podcasting. This was done by the primary author and discussed periodically with the research team to enhance rigour and reduce bias.

Results

Study characteristics. Twenty-six studies were included in the review as shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart

in Fig. 2.

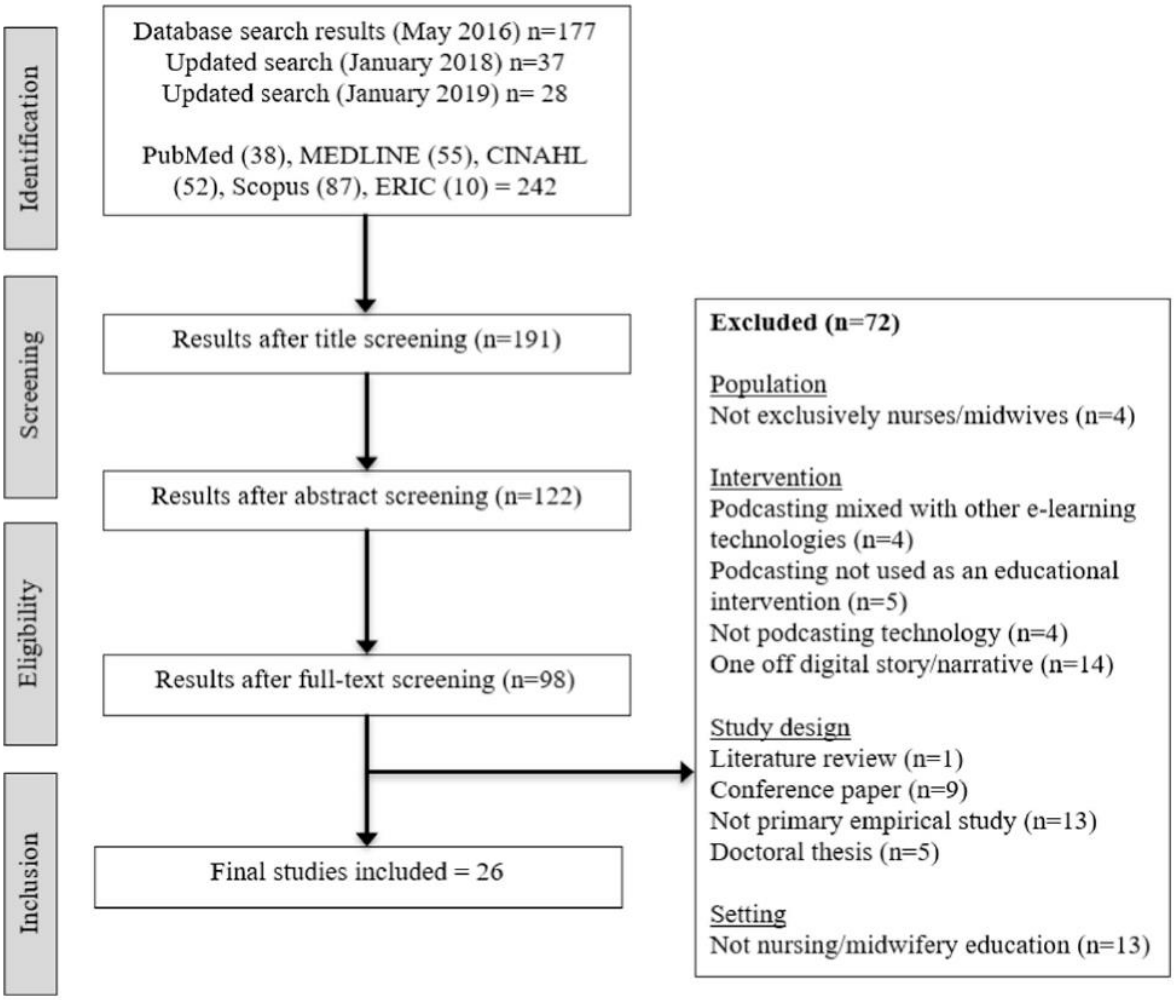

Fig. 2. PRISMA flow chart of the screening process

Overall, the quality of included studies was weak, with seventeen rated low quality, eight rated medium and one study rated high quality. The studies on podcasting took place from 2008 to 2018, across five countries. Sixteen articles were from the United States (Forbes and Hickey, 2008; Johnston et al., 2010; Kardong-Edgren and Emerson, 2010; Kemp et al., 2010; Schlairet, 2010; Vogt et al., 2010; Gipson and Richards, 2011; Greenfield, 2011; Stiffler et al., 2011; Meek et al., 2012; Abate, 2013; Lyons, 2013; Blum 2014, 2018; Price et al., 2015;

Hargett, 2018), seven from the United Kingdom (McKinney and Page, 2009; Meade, Bowskill et al. 2009, 2011; Clay, 2011; Mostyn et al., 2013; Fenton, 2014; McSwiggan and Campbell, 2017), and one from Australia (Rogan and San Miguel, 2013), Norway (Foss et al., 2013) and Iran (Abedian et al., 2018) (see Table 1). The population of learners were mainly undergraduate nursing students, although four studies included graduate nurses (Meade, Bowskill et al. 2009, 2011; Stiffler et al., 2011; Meek et al., 2012), one focused on nurse preceptors (Blum, 2014), and another had a mixture of pre-registration and post-registration nurses (Schlairet, 2010). Two studies centred on the midwifery profession, one focusing on midwives undertaking postgraduate training (Clay, 2011) and another on midwifery students (Abedian et al., 2018). The majority of participants were female, aged between 20 and 40, although thirteen studies did not report gender and twelve did not report age. The ethnicity and socioeconomic status of participants were rarely described (see Appendix D).

The type of technology used to create and host podcasting interventions varied widely and in some studies the podcasts were not described in detail. Software such as Apple's GarageBand, Audacity, Dreamweaver, Final Cut Pro, Microsoft's Movie Maker, VoiceThread and devices such as MP3 players and digital cameras were used to create a range of digital learning resources. These were primarily hosted on virtual learning environments (e.g. Blackboard, WebCT) but also university websites or YouTube in a few cases. Almost all studies created the podcast content, bar one which used a commercially available podcast (Hargett, 2018). Most podcasts were informative describing or explaining a wide range of topics in nursing and healthcare, while four were guidelines about practical skills (Clay, 2011; Lyons, 2013, Rogan and San Miguel, 2013; Blum, 2018), and one was feedback related giving assessment guidance (McSwiggan and Campbell, 2017). Nineteen were developed exclusively by teaching staff. Only three studies used students (Lyons, 2013, Rogan and San Miguel, 2013; Price et al., 2015), two had professional nurses or preceptors from practice

(Price et al., 2015; Blum, 2018) and two had patients or families (Fenton, 2014; Price et al., 2015) involved in developing the podcasting material. In addition, only six studies were underpinned by a pedagogical or other theory (Kardong-Edgren and Emerson, 2010; Kemp et al., 2010; Schlairet, 2010; Abate, 2013; Blum, 2014; McSwiggan and Campbell, 2017).

Learning outcomes such as knowledge and skills acquisition were measured in several cases (McKinney and Page, 2009; Meade et al., 2009; Clay, 2011; Gipson and Richards, 2011; Meek et al., 2012; Abate, 2013; Lyons, 2013, Rogan and San Miguel, 2013; Blum, 2014; Fenton, 2014; Price et al., 2015; Abedian et al., 2018; Blum, 2018; Hargett, 2018) and exam grades in others (Johnston et al., 2010; Kemp et al., 2010; Greenfield, 2011). Some studies examined the views of nursing or midwifery students, educators or clinical staff in relation to using podcasts for learning. Psychometrically tested, valid and reliable tools were generally not used when measuring outcomes. The vast majority of studies used some type of quasi-experimental design such as a questionnaire or survey, while two took purely qualitative approaches using interviews (Meade et al., 2011) and focus groups (McSwiggan and Campbell, 2017) with nursing students. One study undertook a pilot randomized trial (Abate, 2013) and four employed mixed methods i.e. a combination of surveys with focus groups (Johnston et al., 2010; Clay, 2011; Mostyn et al., 2013; Price et al., 2015). No quantitative studies demonstrated sufficient rigour to determine the efficacy of podcasting on learning.

4.2. Learning and other outcomes Overall, podcasting as an educational technology appears to have had a positive impact on how nurses, midwives and students of these professions learned. Several outcomes emerged from the synthesis of the review findings, namely knowledge and skills acquisition, and improved confidence (see Table 2). However, in a few studies some participants reported not learning anything from listening to podcasts,

compared to accessing more traditional forms of education (Johnston et al., 2010; Kemp et al., 2010; Vogt et al., 2010; Gipson and Richards, 2011; Meek et al., 2012). Other studies noted the understanding of nursing students or practice staff improved via podcasting without specifying what knowledge or skills were acquired (Forbes and Hickey, 2008; Schlairet, 2010; Blum, 2014).

Knowledge. The most frequent benefit reported by undergraduate and graduate nursing students was they perceived that they gained a better understanding of subject matter such as pharmacology (Meade, Bowskill et al. 2009, 2011; Abate, 2013), pathophysiology (McKinney and Page, 2009), research (Strickland et al., 2012), microbiology (Foss et al., 2013), religious issues surrounding egg donation (Abedian et al., 2018), and the patient experience of healthcare (Fenton, 2014). In three cases, undergraduate nursing students perceived that podcasting enhanced their application of newly acquired knowledge such as pharmacology, medical terminology and palliative care in practice (Abate, 2013, Rogan and San Miguel, 2013; Price et al., 2015). Several other studies reported that nursing students and graduate nurses believed knowledge learned from listening to podcasts could be useful when preparing for examinations and assessments (McKinney and Page, 2009; Kardong-Edgren and Emerson, 2010; Vogt et al., 2010; Greenfield, 2011; Meade et al., 2011; Mostyn et al., 2013; McSwiggan and Campbell, 2017).

Skills. Undergraduate nursing students also reported learning a number of useful skills by listening to podcasts. Communication skills, both verbal and non-verbal, were the most frequently described skill gain through using podcasting (Rogan and San Miguel, 2013; Fenton, 2014). Study skills, research, critical thinking and stress management techniques were also noted as being learned by nursing students in a few studies (Greenfield, 2011; Lyons, 2013; McSwiggan and Campbell, 2017; Blum, 2018; Hargett, 2018).

Confidence. One other outcome identified from using podcasting was improvements in confidence among nursing and midwifery undergraduate and graduate students (Clay, 2011; Meade et al., 2011, Rogan and San Miguel, 2013; McSwiggan and Campbell, 2017). For example, first year nursing students in Rogan and San Miguel (2013) believed they were better prepared to undertake clinical placements from listening to podcasts as they had a better grasp of clinical knowledge or skills that would enable them to work well in professional practice. Similarly, Clay (2011), noted midwifery students felt more confident in performing clinical skills after listening to podcasts about undertaking a physical examination of a newborn infant. In McSwiggan and Campbell (2017), nursing students felt confident in seeking academic support and reassured of their ability to undertake end of year examinations once they had listened to podcasts on scenario based summative assessments. Lastly Meade et al. (2011), reported graduate nurses were more self-assured of their knowledge of pharmacology due to receiving podcasts on this subject.

4.3. Antecedents to learning. Several aspects required to deliver podcasting as an educational intervention arose. These were categorised into four themes which were; 1) organisation of social media, 2) digital literacy and e-Professionalism, 3) personal motivation, and 4) flexible access (see Table 2).

Organisation of social media. How well podcasting was organised as an educational intervention seemed to affect the level of engagement from students, which could have impacted learning. The awareness of podcasting as a resource among pre-registration nursing students was an issue in some studies (Mostyn et al., 2013; Rogan and San Miguel, 2013) while in others, students suggested having written instructions accompany a podcast as a way to enhance learning (Vogt et al., 2010; Rogan and San Miguel, 2013). In Meade et al. (2011), graduate nursing students benefited from IT support.

Digital literacy and e-Professionalism. A handful of studies reported that some undergraduate and graduate nursing students had poor digital literacy skills and struggled to use the software or hardware required to access and play podcasts (McKinney and Page, 2009; Meade et al., 2011). On the other hand, other studies such as Fenton, (2014) and Johnston et al. (2010), reported that no undergraduate nursing students had difficulty with the technology as their technical skills were proficient and they found the podcasts easy to use.

Personal motivation. Whether nursing students were motivated enough to access and listen to podcasts seemed to impact how much they participated in learning. A few studies reported varying levels of motivation and engagement with the technology, which tended to decrease when undergraduate or graduate nursing students were busy and had other priorities such as assessments to complete (Vogt et al., 2010; Meade et al., 2011; McSwiggan and Campbell, 2017).

Flexible access. Podcasting as a technology seemed to give more flexibility to students in terms of learning as they could access electronic files anywhere, anytime. This appeared to be particularly convenient in clinical areas if nursing students (Greenfield, 2011) and graduate midwives (Clay, 2011) needed to refresh subject knowledge quickly. It also fitted with the busy lifestyles of many undergraduate and graduate nursing and midwifery students as they could control when and where they learned (McKinney and Page, 2009; Kardong-Edgren and Emerson, 2010; Vogt et al., 2010; Clay, 2011; Gipson and Richards, 2011; Greenfield, 2011; Meade et al., 2011; Mostyn et al., 2013, Rogan and San Miguel, 2013; McSwiggan and Campbell, 2017). However, accessing podcasts was not always possible due to slow Internet speeds when downloading large files (Meade et al., 2011). Mobile devices or computers that were incompatible with and did not support podcasting software and other technical difficulties such as navigating the virtual learning environment

also affected accessibility (McKinney and Page, 2009; Meade et al., 2009; Clay, 2011; Gipson and Richards, 2011; Lyons, 2013; Mostyn et al., 2013). In a few instances, pre and post registration nursing students did not own the right equipment to access and use podcasts (McKinney and Page, 2009; Meade et al., 2011). These issues could detract from students' ability to learn.

4.4. Learning process Several mechanisms of the learning process were drawn from a number of included studies and synthesised into six themes (see Table 2). These were; 1) speed of exchange, 2) social media users, 3) timeframe, 4) quality of information, 5) functionality of social media, and 6) other learning activities.

Speed of exchange. A few undergraduate nursing students noted there was limited opportunity to ask questions and exchange information quickly with faculty or other students to clarify points of uncertainty when using podcasts, as this is not a function of the technology. This seemed to negatively impact learning (McKinney and Page, 2009).

Social media users. Undergraduate nursing students who had a preference for aural learning seemed to enjoy listening to podcasts and took a lot from them (Mostyn et al., 2013). However, there were undergraduate nursing students some who did not like using the technology or preferred traditional classroom based approaches to learning (Vogt et al., 2010; Stiffler et al., 2011; McSwiggan and Campbell, 2017). Hence, it may not be useful for all nursing and midwifery students and practice staff given the diversity within these professions. On the other hand Kardong-Edgren and Emerson (2010), reported a nursing student with a learning disability seemed to like the podcasts as they helped them learn new knowledge and skills. It also appeared useful for international nursing students whose native language was not English as they could use the audio recordings to improve their pronunciation and vocabulary (Greenfield, 2011; Rogan and San Miguel, 2013).

Timeframe. The frequency and duration of podcasting use was not always reported. However, being able to control the pace of learning seemed to help undergraduate and graduate nursing students refresh existing knowledge. It also enabled them to remember material missed during class or catch up if a class was skipped, as podcasts could be listened too as often and as long as needed (Meade, Bowskill et al. 2009, 2011; Schlairet, 2010; Stiffler et al., 2011). Greenfield (2011) also reported nursing students who were non-native English speakers were able to focus more in class as they were not under pressure to take notes because podcasts of the lecture content were available when required. This enabled students to make the best use of time available for learning. However, Gipson and Richards (2011), reported a senior baccalaureate nursing student felt listening to podcasts and attending class required extra time and energy which caused them to lose interest in the technology.

Quality of information. Both undergraduate and graduate nursing and midwifery students perceived information on podcasts varied in terms of its quality. A number of studies highlighted that students believed educational information was accurate, consistent and easy to listen to which seemed to improve learning (Clay, 2011; Meade et al., 2011, Rogan and San Miguel, 2013; McSwiggan and Campbell, 2017). However, some nursing students felt there was poor quality information on certain podcasts (McSwiggan and Campbell, 2017). This was sometimes due to background noise when recording audio which could detract from learning (Meade et al., 2009; Mostyn et al., 2013). The varying quality of podcasts among nurse educators was also mentioned (Meade et al., 2009).

Functionality of social media. Some studies reported that podcasts were easy for nursing students and graduate midwifery students to navigate (Clay, 2011; Mostyn et al., 2013; Fenton, 2014). When the pedagogical content was well structured and paced it appeared to facilitate the learning process for both undergraduate and graduate nursing

students (Meade et al., 2009; McSwiggan and Campbell, 2017) and practice staff (Blum, 2014). In Fenton (2014) suggestions were made on how to improve the interface and content such as providing links to additional educational resources.

Other learning activities. Pre and post-registration nurses sometimes combined podcasting with other activities such as reading lecture slides, note taking, reading textbooks and discussing digital content in study groups and online forums, which appeared to enhance the learning process (Kardong-Edgren and Emerson, 2010; Schlairet, 2010; Meade et al., 2011; Stiffler et al., 2011; McSwiggan and Campbell, 2017). In one case, a small number of nursing students used podcasts before they commenced class to get a head-start on the material (Forbes and Hickey, 2008), while another emphasised the technology should not replace face-to-face teaching time or other forms of gaining information such as emailing faculty (McSwiggan and Campbell, 2017).

5. Discussion

5.1. Principal findings

This integrative review provides the first rigorous synthesis of the current evidence on podcasting in nursing and midwifery education. It identifies key learning outcomes, namely new knowledge and skills, that students appeared to attain through the use of podcasts which were relevant to professional practice. In a few instances, the technology seemed particularly helpful for international students and those with learning disabilities and appeared to improve confidence among some students. Notably, a Social Media Learning Model (O′Connor et al., 2018) helped to conceptualise the use of this digital tool in nursing and midwifery education. From this, key elements of the learning process such as the speed of exchange, timeframe, quality of information and functionality of social media among others were uncovered.

Several aspects needed to deliver podcasting also emerged such as how well it was organised, the accessibility of the technology, digital literacy skills of staff and students, and whether students were motivated to learn. The application of the learning model to podcasting demonstrated that this type of social media is slightly different to social networking applications, as a number of mechanisms in the original model such as ‘Virtual interaction’, ‘Student-centred setting’, ‘Social support’, and ‘Role modelling’ were not present in this review. However, several mechanisms were similar and a new one ‘Other learning activities’ emerged from the findings of this review, revealing podcasts may have a unique property that could enhance learning. Hence, a refined version of the Social Media Learning Model for podcasting based on the results of this review is suggested (see Fig. 3).

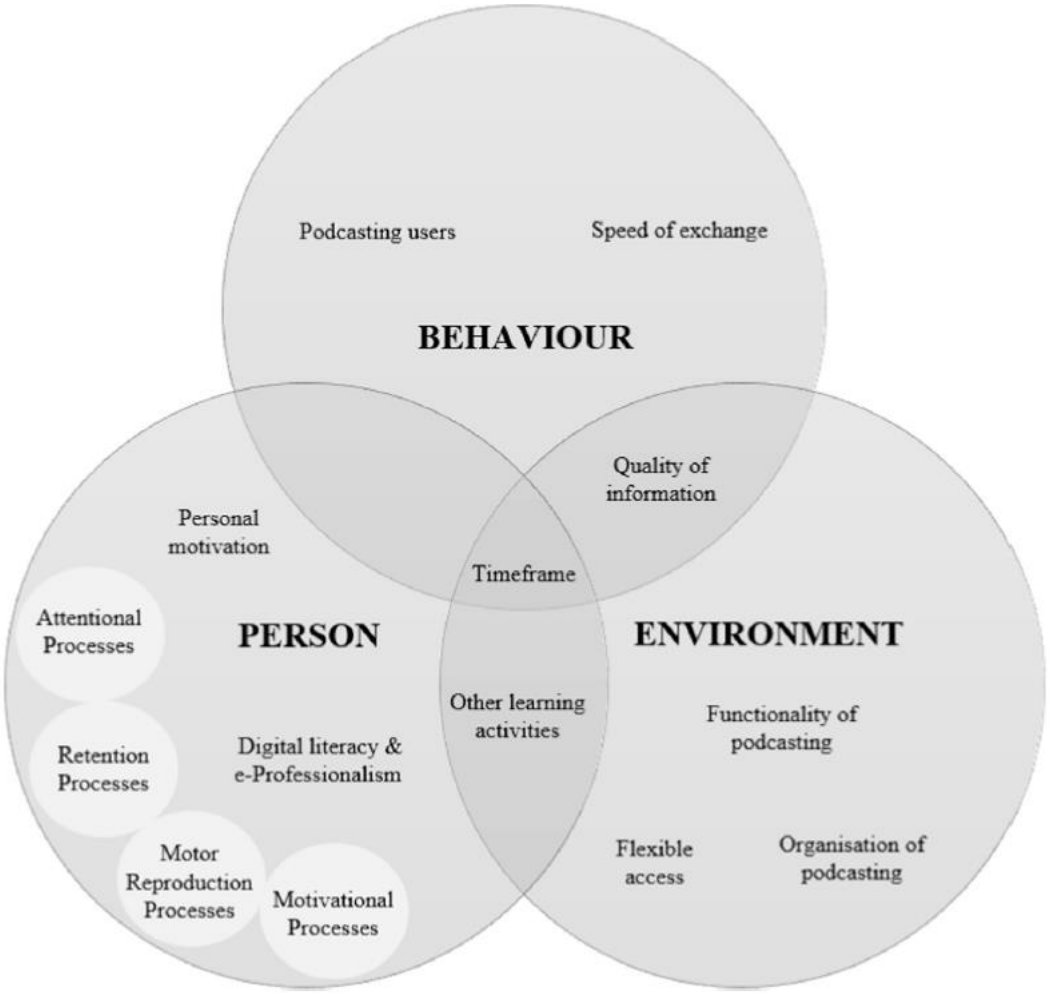

Fig. 3. Social Media Learning Model (SMLM).

5.2. Strengths and weaknesses of the review

This review has a number of strengths including a robust approach to the integrative method by employing an established process and the use of best practice guidelines such as PRISMA to improve reporting. The further development of a Social Media Learning Model to aid our understanding of how nursing and midwifery students learn via podcasting technology also strengthens the findings. Yet a number of limitations are present such as the exclusion of grey literature, conference proceedings, theses and studies in languages other than English which means some relevant articles may have been missed. The studies are primarily based in high income countries which may introduce some cultural and other bias as educational settings

and students could be different in low and middle-income nations. Furthermore, many of the included studies were low in quality, had poor descriptions of the participant characteristics, key stakeholders such as nursing and midwifery educators and practice staff were largely overlooked, and weak study designs were used. The features of the podcasting interventions were also poorly explained in many studies, meaning an in-depth comparison between different types was not feasible limiting the utility of the findings. Hence, the review results should be interpreted with caution.

5.3. Comparison with existing literature.

The review showed that nursing and midwifery students seemed to learn new knowledge and skills by utilising podcasts and in some cases their confidence also improved. These findings are supported by other research on podcasting in the wider health education literature. Moreau, Eady et al. (2018) found that knowledge of concepts such as cultural and spiritual health as well as disease specific expertise improved among clinicians through the use of digital patient stories. Similarly, White et al. (2011) examined how medical students undertaking surgical training engaged with audio podcasts, reporting it helped them learn core topics. Hurst (2016) also showed vodcasts could improve the acquisition of clinical skills among physiotherapy students. However, Schreiber et al. (2010) undertook a Randomized Controlled Trial (RCT) with one hundred medical students' using video podcasts of lectures. No statistical improvement was found in knowledge after using the digital pedagogical tool, indicating it may not be effective in enhancing learning.

Although podcasts as a pedagogical intervention were not well described in the included studies, aspects of the learning process identified in this integrative review have been reported by others. Strickland, Gray et al. (2012) noted nursing and allied health students valued podcasts as the information was recorded by teaching staff whom they knew

which enhanced the quality, making the podcasts easier to understand. Stacey and Hardy (2011) also emphasised the importance of high quality personalised educational content in digital stories as it helped newly qualified nurses reflect on and improve their practice. Other elements needed for learning identified in this review such as the timeframe was present in both Burke and Cody (2014) and Carpenter et al. (2013) who reported nursing students accessed podcasts multiple times per week and valued the ability to listen to these for as long and as often as needed. Marrocco, et al. (2014) also noted some students viewed podcasts as extra work, although those with learning disabilities appreciated the technology as it suited their needs. Similar to this review, Levett-Jones et al. (2015) highlighted that if tutors did not use digital stories or relate to them in class, some students became disinterested due to a lack of exchange.

Some of the building blocks needed to deliver podcasting as an educational intervention identified in this review have also been discussed elsewhere. Shellenbarger and Robb (2015) emphasised the importance of faculty in providing clear guidelines on how nursing students can use digital stories and integrating these well into the learning experience to promote clinical reasoning skills. Furthermore, digital literacy has been raised in the past as Savel et al. (2007) explained how a critical care podcasting series was created but clinicians′ lack of computer skills hindered engagement with the technology. In Snelgrove et al. (2016) faculty requested further training on eLearning tools and while students had access to digital patient narratives, this was sometimes limited due to poor Internet at home. Personal motivation also appeared to play a part as Stacey and Hardy (2011) noted nursing students were motivated to help create digital stories as it enabled them reflect on clinical experiences and help themselves and others learn. Finally, in keeping with the findings of this review Boulos et al. (2006) highlighted podcasts are a flexible resource that can be accessed anywhere, anytime to facilitate mobile learning.

5.4. Implications for practice and future research

Podcasting is becoming established as a popular social media tool to help educate nurses, midwives and students of these professions in higher and continuing education. In the future, it is likely to be used more regularly or it may become compulsory that all teaching resources are available via podcasts, vodcasts or audiobooks to give students more diverse material and methods through which to learn, particularly during the current coronavirus pandemic where students must be taught remotely (Williamson et al., 2020). More research that employs robust experimental approaches to establish if podcasts improve learning is needed, so educators know investing in this technology is worthwhile. Richer descriptions of student populations and podcasting interventions would also be beneficial to enhance transparency, replicability and the generalisability of future research, as the diversity of students, technologies and educational resources could affect learning in different ways. Research that explores educators′ views on podcasting and those of other key stakeholders such as qualified nursing and midwifery staff, leaders and managers in academic and clinical settings, learning technologists and policy makers would also be welcome to ensure this technology can be developed and deployed appropriately across higher and continuing education.

As more novel technology comes on-stream podcasting may be eclipsed by virtual and augmented reality, serious gaming, avatars or chatbots that enable students to learn via more visual and interactive means (Bayne, 2015; Irwin and Coutts, 2015; O′Connor, 2019), or it could be integrated with these to extend the usefulness of this rather simplistic digital tool. This would require nurse educators to upskill in these technologies and further investment in hardware, software, learning spaces and technical support would be necessary to deliver more advanced digital learning tools (Farra et al., 2018; Pront et al., 2018). Some considerations should also be made for nursing and midwifery students whose digital literacy,

computer or mobile equipment, or Internet access may be poor as this could hinder their engagement with and learning from podcasts. Hence, additional resources could be provided by educators for this. Co-creating podcasting content with students or availing of good quality commercial or freely available podcasts may also help nursing or midwifery educators overcome some of the limitations of producing teaching material for this educational technology (Hennig, 2017; Phillips, 2017). Faculty may also support open access education initiatives by making podcasts accessible online for free, as has been done in some areas of medical and social work education (Fronek et al., 2016; Lin et al., 2016). Further theoretical development of the Social Media Learning Model would also be useful to help explain the complex processes by which students learn when using podcasts and other types of social media. This educational framework could help to create, deliver and evaluate better quality pedagogical interventions that support a diverse range of students.

6. Conclusion

This integrative review has provided the first rigorous synthesis of podcasting in nursing and midwifery education, which aids our understanding of this pedagogical tool. Tentative evidence that podcasts could improve learning emerged as the technology appeared to enhance knowledge and skills, in particular for international students and those with special learning needs. The review identified various podcasting interventions and their application in nursing and midwifery training which may benefit both educators and students when planning and operationalising learning. A Social Media Learning Model was also employed to elicit the fundamental components of developing and delivering podcasting in higher and continuing education. However, further research that robustly tests the efficacy of podcasts and objectively measures improvements in learning outcomes among more diverse groups of students and settings is needed. This would help clarify the value of this technology in

nursing and midwifery education, so it could be used to positively influence professional practice and patient care. Educators who are going to use podcasting may wish to consider the digital skills of staff and students, how to create appropriate student-centred content, and organise and integrate podcasting in curricula before introducing this technology.

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Appendix A. Supplementary data Supplementary data to this article can be found online at https://doi.org/10.1016/j.nepr.2020.102827

Abbreviations

ANOVA Analysis Of Variance

ECG Electrocardiograms

CSS Cascading Style Sheets

ESL English as a Second Language

GB Gigabyte

HSRT Health Sciences Reasoning Test

IT Information Technology

JBI Joanna Briggs Institute

MCQ Multiple Choice Question

MeSH Medical Subject Heading

MP3 MPEG Audio Layer III

MPEG-4 - Moving Picture Experts Group

NIPE Newborn Infant Physical Examination

PPT PowerPoint

PRISMA Preferred Reporting Items for Systematic Reviews and Meta- Analyses

RCT Randomized Controlled Trial

SMLM Social Media Learning Model

SPSS Statistical Package for the Social Sciences

UGE Uses and Gratification Expectancy

xHTML eXtensible HyperText Markup Language

References

Abate, S.K., 2013. The effect of podcast lectures on nursing students′ knowledge retention and application. Nurs. Educ. Perspect. 34 (3), 182–185.

Abedian, Z., Nosrati, F., Sadeghi, T., Hejazi, S.A., Feizabadi, M.J.J., 2018. Comparing the effect of workshop and podcast training on knowledge and performance of midwifery students regarding legal and religious aspects of egg donation. J. Midwifery.Reprod. Health 6 (3), 1319–1326.

Bandura, A., 1977. Social Learning Theory. Englewood Cliffs; London, Englewood Cliffs. Prentice-Hall, London.

Blum, A.C., 2018. Does podcast use enhance critical thinking in nursing education? Nurs. Educ. Perspect. 39 (2), 91–93.

Bayne, S., 2015. Teacherbot: Interventions in Automated Teaching. Teaching in Higher Education vol. 20 (4), 455–467.

Blum, C.A., 2014. Evaluating preceptor perception of support using educational podcasts. Int. J. Nurs. Educ. Scholarsh. 11 (1), 47–54.

Boulos, M., Maramba, I., Wheeler, S., 2006. Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. BMC Med. Educ. 6 (1), 41.

Burke, S., Cody, W., 2014. Podcasting in undergraduate nursing programs. Nurse Educat. 39 (5), 256–259.

Button, D., Harrington, A., Belan, I., 2014. E-learning & information communication

technology (ICT) in nursing education: a review of the literature. Nurse Educ. Today 34 (10), 1311–1323.

Carpenter, R., Theeke, L., Smothers, A., 2013. Enhancing course grades and evaluations using distance education technologies. Nurse Educat. 38 (3), 114–117.

Clay, C.A., 2011. Exploring the use of mobile technologies for the acquisition of clinical skills. Nurse Educ. Today 31 (6), 582–586.

Duke, V.J.A., Anstey, A., Carter, S., Gosse, N., Hutchens, K.M., Marsh, J.A., 2017. Social media in nurse education: utilization and E-professionalism. Nurse Educ. Today 57, 8–13.

Farra, L.S., Smith, J.S., Ulrich, L.D., 2018. The student experience with varying immersion levels of virtual reality simulation. Nurs. Educ. Perspect. 39 (2), 99–101.

Fenton, G., 2014. Involving a young person in the development of a digital resource in nurse education. Nurse Educ. Pract. 14 (1), 49–54.

Forbes, O.M., Hickey, T.M., 2008. Podcasting: implementation and evaluation in an undergraduate nursing program. Nurse Educat. 33 (5), 224–227.

Foss, B., Oftedal, B.F., Lokken, A., 2013. Rich media e-compendiums: a new tool for enhanced learning in higher education. Eur. J. Open Dist. E Learn. 16 (1), 102.

Fronek, P., Boddy, J., Chenoweth, L., Clark, J., 2016. A report on the use of open access podcasting in the promotion of social work. Aust. Soc. Work 69 (1), 105–114.

Gipson, M., Richards, J., 2011. Student engagement through podcasting. Nurse Educat. 36 (4), 161–164.

Greenfield, S., 2011. Podcasting: a new tool for student retention? J. Nurs. Educ. 50 (2), 112–114.

Hargett, J.L., 2018. Podcasting in nursing education: using commercially prepared podcasts to spark learning. Teach. Learn. Nurs. 13 (1), 55–57.

Hart, T., Bird, D., Farmer, R., 2019. Using blackboard collaborate, a digital web conference tool, to support nursing students placement learning: a pilot study exploring its impact. Nurse Educ. Pract. 38, 72–78.

Hennig, N., 2017. Podcast Literacy: Educational, Accessible, and Diverse Podcasts for Library Users. Library Technology Reports, p. 1.

Hurst, K.M., 2016. Using video podcasting to enhance the learning of clinical skills: a qualitative study of physiotherapy students' experiences. Nurse Educ. Today 45, 206–211.

Irwin, P., Coutts, R., 2015. A systematic review of the experience of using second life in the education of undergraduate nurses. J. Nurs. Educ. 54 (10), 572.

Johnston, R., Hepworth, J., Goldsmith, M., Lacasse and, C., 2010. Use of iPodTM technology in medical-surgical nursing courses: effect on grades. Int. J. Nurs. Educ. Scholarsh. 7 (1).

Kardong-Edgren, S., Emerson, R., 2010. Student Adoption and Perception of Lecture Podcasts in Undergraduate Bachelor of Science in nursing courses. J. Nurs. Educ. vol. 49, 398–401, 7.

Kemp, P.K., Myers, C.E., Campbell, M.R., Pratt, A.P., 2010. Student perceptions and the effectiveness of podcasting in an Associate Degree Nursing program. Teach. Learn. Nurs. 5

(3), 111–114.

Levett-Jones, T., Bowen, L., Morris, A., 2015. Enhancing nursing students′ understanding of threshold concepts through the use of digital stories and a virtual community called ‘Wiimali’. Nurse Educ. Pract. 15 (2), 91–96.

Lin, M., Joshi, N., Grock, A., Swaminathan, A., Morley, E.J., Branzetti, J., Taira, T., Ankel, F., Yarris, L.M., 2016. Approved instructional resources series: a national initiative to identify quality emergency medicine blog and podcast content for resident education. J. Grad.Med. Educ. 8 (2), 219.

Lyons, T., 2013. Omnipresent learning via interactive media. J. Electron. Resour. Med. Libr. 10 (3), 119–131.

Maag, M., 2006. Podcasting and MP3 players: emerging education technologies. Comput. Inf. Nurs. 24 (1), 9–13.

Marrocco, F.G., Wallace Kazer, F.M., Neal-Boylan, F.L., 2014. Transformational learning in graduate nurse education through podcasting. Nurs. Educ. Perspect. 35 (1), 49–53.

McKinney, A.A., Page, K., 2009. Podcasts and videostreaming: useful tools to facilitate learning of pathophysiology in undergraduate nurse education? Nurse Educ. Pract. 9 (6), 372–376.

McSwiggan, L.C., Campbell, M., 2017. Can podcasts for assessment guidance and feedback promote self-efficacy among undergraduate nursing students? A qualitative study. Nurse Educ. Today 49, 115–121.

Meade, O., Bowskill, D., Lymn, J.S., 2009. Pharmacology as a foreign language: a

preliminary evaluation of podcasting as a supplementary learning tool for non-medical prescribing students. BMC Med. Educ. 9 (1), 74-74.

Meade, O., Bowskill, D., Lymn, J.S., 2011. Pharmacology podcasts: a qualitative study of non-medical prescribing students′ use, perceptions and impact on learning. BMC Med. Educ. 11 (1), 2-2.

Meek, A.J., Lee, A.M., Jones, A.J., Mutea, A.N., Prizevoits, A.A., 2012. Using podcasts to help students apply health informatics concepts: benefits and unintended consequences. Comput. Inf. Nurs. 30 (8), 426–439.

Moreau, K.A., Eady, K., Sikora, L., Horsley, T., 2018. Digital storytelling in health professions education: a systematic review.(Report). BMC Med. Educ. 18 (1).

Mostyn, A., Jenkinson, C., McCormick, D., Meade, O., Lymn, J., 2013. An exploration of student experiences of using biology podcasts in nursing training. BMC Med. Educ. 13, 12.

O′ Connor, S., Jolliffe, S., Stanmore, E., Renwick, L., Booth, R., 2018. Social media in nursing and midwifery education: a mixed study systematic review. J. Adv. Nurs. 74 (10), 2273–2289.

O′Connor, S., 2019. Virtual reality and avatars in health care. Clin. Nurs. Res. 28 (5), 523–528.

O′Connor, S., Andrews, T., 2015. Mobile technology and its use in clinical nursing education: a literature review. J. Nurs. Educ. 54 (3), 137.

O′Connor, S., Andrews, T., 2018. Smartphones and mobile applications (apps) in clinical nursing education: a student perspective. Nurse Educ. Today 69, 172.

O′Connor, S., Chu, C.H., Thilo, F., Lee, J.J., Mather, C., Topaz, M., 2020. Professionalism in a digital and mobile world: a way forward for nursing. J. Adv. Nurs. 76 (1), 4–6.

Patton, M.Q., 2002. Qualitative Research and Evaluation Methods. Thousand Oaks, Calif. Sage, London.

Phillips, B., 2017. Student-produced podcasts in language learning–exploring student perceptions of podcast activities. IAFOR Journal of Education 5 (3), 157–171.

Price, D.M., Strodtman, L., Brough, E., Lonn, S., Luo, A., 2015. Digital storytelling: an innovative technological approach to nursing education. Nurse Educat. 40 (2), 66–70.

Pront, L., Müller, A., Koschade, A., Hutton, A., 2018. Gaming in nursing education: a literature review. Nurs. Educ. Perspect. 39 (1), 23–28.

Rogan, F., San Miguel, C., 2013. Improving clinical communication of students with English as a second language (ESL) using online technology: a small scale evaluation study. Nurse Educ. Pract. 13 (5), 400–406.

Savel, R.H., Goldstein, E.B., Perencevich, E.N., Angood, P.B., 2007. The iCritical care podcast: a novel medium for critical care communication and education. J. Am. Med. Inf. Assoc. 14 (1), 94–99.

Schlairet, M.C., 2010. Efficacy of podcasting: use in undergraduate and graduate programs in a college of nursing. J. Nurs. Educ. 49 (9), 529–533.

Schreiber, B., Fukuta, J., Gordon, F., 2010. Live lecture versus video podcast in undergraduate medical education: a randomised controlled trial. BMC Med. Educ. 10(1), 68.

Shellenbarger, T., Robb, M., 2015. Technology-based strategies for promoting clinical

reasoning skills in nursing education. Nurse Educat. 40 (2), 79–82.

Sinclair, P.M., Kable, A., Levett-Jones, T., Booth, D., 2016. The effectiveness of Internet-based e-learning on clinician behaviour and patient outcomes: a systematic review. Int. J. Nurs. Stud. 57, 70–81.

Snelgrove, S., Tait, D.J.R., Tait, M., 2016. Teaching psychology to student nurses: the use of "talking head" videos. Res. Learn. Technol. 24 (1), 1–15.

Stacey, G., Hardy, P., 2011. Challenging the shock of reality through digital storytelling. Nurse Educ. Pract. 11 (2), 159–164.

Stiffler, D., Stoten, S., Cullen, D., 2011. Podcasting as an instructional supplement to online learning: a pilot study. Computers, informatics, nursing: CIN Plus 29 (6 Suppl. l), TC84.

Strickland, K., Gray, C., Hill, G., 2012. The use of podcasts to enhance research-teaching linkages in undergraduate nursing students. Nurse Educ. Pract. 12 (4), 210–214.

Surry, D.W., Farquhar, J.D., 1997. Diffusion theory and instructional technology. Journal of Instructional Science and Technology 2 (1), 24–36.

Vogt, M., Schaffner, B., Ribar, A., Chavez, R., 2010. The impact of podcasting on the learning and satisfaction of undergraduate nursing students. Nurse Educ. Pract. 10 (1), 38–42.

White, J.S., Sharma, N., Boora, P., 2011. Surgery 101: evaluating the use of podcasting in a general surgery clerkship. Med. Teach. 33 (11), 941–943.

Whittemore, R., Knafl, K., 2005. The integrative review: updated methodology. J. Adv. Nurs. 52 (5), 546–553.

Williamson, B., Eynon, R., Potter, J., 2020. Pandemic politics, pedagogies and practices: digital technologies and distance education during the coronavirus emergency. Learn. Media Technol. 45 (2), 107–114.

Table 1 Details of included studies

No	Author, Year, Country	Research Aims, Theory & Setting	Methods	Participants	Podcasting Intervention	Findings
1	Abate (2013), USA	Aim: Evaluate podcasts design in improving retention and application of pharmacology. Theory: Bloom's Taxonomy used to design the 10-item questionnaire. Setting: Academic. Quality: Low.	Design: Pilot study with 3 randomized arms; 1) traditional lecture, 2) unsegmented podcast or 3) segmented podcast. Data collection: 10-item MCQ and case study scenario. Analysis: Kruskal-Wallis Test, mean and standard deviation.	Convenience sample of female undergraduate nursing students (lecture n = 12; unsegmented podcast n = 11; segmented podcast n = 12).	Developed: by faculty. GarageBand software, Logitech headphone with a microphone. Content: Pharmacology Duration: Non-segmented podcast was >57 min long and segmented podcast was >51 min long. Access: via1GB flash drives given to all participants. Could be listened to anytime on computers or MP3 players.	90.5% (n = 19/23) students listened to the podcasts. 19% strongly agree and 62% agreed that the podcast helped them remember pharmacology concepts. 25% strongly agreed and 50% agreed that the podcasts helped them apply pharmacological concepts. Students in the segmented podcast group had the highest mean scores in both retention and application assessments.
2	Abedian et al. (2018), Iran2	Aim: investigate effects of podcasts on midwifery students' knowledge and educational performance regarding donor egg recipients. Setting: Academic. Quality: Low.	Design: pre and post-test study. Data collection: a self-designed knowledge measurement questionnaire and objective structured clinical exam. Analysis: Kolmogorov-Smirnov test, independent *t*-test and Chi-square test, paired *t*-test.	Undergraduate midwifery students. Two groups allocated randomly to a podcast intervention or usual teaching method (n = 30 per group).	Developed: by faculty. Content: legal and religious issues associated with egg donation. Duration: three MP3 format audio files (25 min each).	The mean knowledge scores on legal and religious issues associated with egg donation were significantly different in both groups (P = 0.004), with a greater difference in the podcast group. No significant differences were observed between them in terms of educational performance (P = 0.63).
3	Blum (2014), USA	Aim: how podcasts could help preceptors learn to	Design: pre-test/post-test followed by a	Nurse preceptors (n = 28), who were	Developed: by practice staff, nurse educators, preceptors,	Preceptors′ perception of support increased after viewing podcasts. The

		approach difficult situations using caring behaviours Theory: Caring principles used to underpin podcast material. Setting: Clinical (large hospital). Quality: Medium.	correlational design. Data collection: 4-part questionnaire measuring demographics, preceptor commitment to role, preceptor's perception of benefit and support scale. Analysis: Descriptive statistics and other analyses on SPSS such as Chronbach alpha and Cohen's f2.	mentoring students (n = 22) and novice nurses (n = 6).	recent preceptees and a caring expert. Content: Video podcasts of scenarios demonstrating unprofessional behaviour, poor communication skills, inability to show knowledge and skills, and attitude problems. Duration: 5–7 min each. Access: Available through a private YouTube channel and a facility intranet.	least experienced preceptors reported the greatest benefits in feeling of support. Preceptors liked the convenience of the medium. They also appreciated seeing different points of view in the videos on how to handle issues with nursing students.
4	Blum (2018), USA	Aim: if use of a podcast would increase students' critical thinking abilities. Theory: Diffusion Theory by Surry and Farquhar (1997) Setting: Academic. Quality: Low quality.	Design: pilot interventional study – correlational interventional pretest/ posttest design Data collection: 34-item Health Sciences Reasoning Test (HSRT) used to assess critical thinking abilities. Analysis: Repeated-measures analysis of variance, Multiple linear regression.	Convenience sample of nursing students in their final semester (control = 17; intervention = 21) in a state college associate in science program.	Developed: by the researcher. Content: supplemental critical thinking podcast media.	Students who received a podcast had greater increase in critical thinking ability than students who receive standardised education only ($F(1, 36) = 1.91$, $p = .088$, $Z2 = .050$). Increased dose had a positive relationship on gains in critical thinking ability (no statistical significance for overall HSRT scores, $F(1, 18) = 1.35$, $R2 = .037$, $p = .261$).
5	Clay (2011), UK	Aim: can a digital learning object used via a mobile device enhances acquisition of skills in clinical settings. Theory: None reported. Setting: Clinical placement.	Design: Not explicitly stated. Data collection: Post intervention evaluation questionnaire and a focus group. Analysis:	Convenience sample of midwives enrolled in a postgraduate new-born infant physical examination	Developed: by faculty. Content: Video files outlining each aspect of a Newborn Infant Physical Examination (NIPE). Duration: 12 weeks. Access: Videos available on a	Students liked having access to educational information when and where they needed it. They felt the accuracy and consistency of the video information was very good (n = 5) or excellent (n = 3) and reflected actual

		Quality: Low.	Approach to analysis not described.	module (n = 8).	virtual learning environment and downloaded onto iPods for use in clinical settings.	clinical practice.
6	Fenton (2014), UK	Aim: evaluate a digital story about a young person′s life-threatening condition with nursing students in terms of teaching and learning. Theory: None reported. Setting: Academic. Quality: Low.	Design: Not explicitly stated. Data collection: Post intervention evaluation questionnaire (with open-ended questions). Analysis: Approach to analysis not described.	Students registered on an undergraduate nursing programme (n = 40).	Developed: by faculty and a patient. Digital template built using xHTML and CSS in Dreamweaver. Audio files added, embedded with images and links to resources. Content: Audio recording of a young person with leukaemia answering questions. Access: virtual learning environment (Blackboard) to access on a range of devices.	Students felt the digital object was a good resource to help them understand a young patients′ perspective, in particular the difficulties she had with inexperienced nurses. The flexibility of the digital learning object appealed to students who could access anytime and it was easy to navigate and use and reflected actual clinical practice.
7	Forbes and Hickey (2008), USA	Aims: Assess the patterns of podcasting using among nursing students and its perceived benefits. Theory: None reported. Setting: Academic. Quality: Low.	Design: Not explicitly stated. Data collection: Survey to assess patterns of student use of podcasting and perceived benefits. Analysis: SPSS used for descriptive statistical. Qualitative data analysed using thematic analysis.	Undergraduate nursing students enrolled in 6 core courses where podcasting was being used (n = 170).	Developed: by faculty. Lapel microphone to audio record lectures and audacity software used for editing academic podcasts. Content: Six nursing ‘‘core’’ courses where podcasting was being used across all semesters. Access: Download from Blackboard (virtual learning environment) to computer or mobile device.	95% of students accessed at least one podcast, to review material before an exam (42.4%) and reinforce content after a class (39.4%). Students reported using podcasts to get a better understanding of a difficult topic, help make notes and repeat material to aid learning. Most students listened to podcasts at home on a computer. Only 16% listened via a mobile device like a MP3 player or iPod.
8	Foss et al. (2013), Norway	Aim: Explore nursing students′ perceptions of e-compendiums as a learning tool. Theory: None reported.	Design: Descriptive quantitative design. Data collection: Questionnaire to evaluate the e-	First semester baccalaureate nursing students over 3 years: 2009, 2010 and 2012	Developed: by faculty. Content: 16 e-compendiums and podcasts on anatomy and pharmacology, microbiology and basic pharmacology.	Of those who used anatomy and physiology podcasts 26% of students rated them as very good and 32% as good learning tools. These results were similar for the microbiology podcasts.

		Setting: Academic. Quality: Low.	compendium resource. Analysis: Approach to analysis not described.	(n = 349).	Access: e-compendium accessible on virtual learning environment (itslearning) and podcasts available through iTunes.	However, 30% of students did not use the podcasts, which was the highest non-usage % of all the eight learning tools available in the e-compendium.
9	Gipson and Richards (2011), USA	Aim: Evaluate the effect of podcasts on student learning about electrocardiograms (ECGs). Theory None reported. Setting: Academic. Quality: Medium.	Design: Quasi-experimental pre-test, post-test comparison group design. Data collection: Surveys and an MCQ. Analysis: Mean and standard deviation calculated. Analysis of covariance undertaken.	Convenience sample of first semester, senior baccalaureate nursing students enrolled in a critical care class (n = 19 lecture group, n = 19 podcast group).	Developed: by faculty. Recorded and edited using Microsoft Movie Maker and Apple GarageBand. Content: Podcasts of the ECG lecture material. Duration: 5 h of material. Access: Made accessible on the course website one day before class.	Student learning through podcasts scored no higher than those learning through traditional lectures. Only 28% watched the entire podcasts and 3 students suggested having shorter clips. Students liked being able to dictate the pace of learning via podcasts and felt they were helpful to learning. Some students had difficulty viewing content online.
10	Greenfield (2011), USA	Aim: Report the grade improvement among English as a second language (ESL) nursing students when using podcasts. Theory: None reported. Setting: Academic. Quality: Low.	Design: not explicitly stated. Data collection: Combination of exam results and questions posed to six ESL students was used. Analysis: not described.	Non-native English-speaking (ESL) nursing students (n = 6) taking a medical-surgical course.	Developed: by faculty. Podcasts were recorded using a digital MP3 player. Content: Medical-surgical lectures and case study discussions were audio recorded. Duration: 10-15- min podcasts of a 90-min class. Access: posted on Blackboard the online course management system.	Some non-ESL students had slight improvements in their grades after using the podcasts. Students used podcasts to review lecture material, as revision for exams and they helped students to concentrate more in class as they knew they would not miss anything as the lecture was recorded. Students liked the flexibility in learning that podcasts provided and it saved them valuable time.
11	Hargett (2018), USA	Aim: Evaluate commercially prepared podcasts to improve students′ critical thinking abilities. Theory: None reported. Setting: Academic.	Design: pilot study. Data collection: online survey. Analysis: not described.	First-year undergraduate bachelor of science in nursing programme (n = 20). Nine students responded to	Developed: self-select one instructor-selected podcast episode of a commercially prepared podcast (This American Life, Radiolab) to utilise in an assignment.	All students (100%) reported that the podcasting assignment sparked learning and/or inspired critical thinking or reflection on the topic. Six students (66.6%) reported that they would recommend podcasting

		Quality: Low.		the survey.	Content: nursing ethics.	assignments be utilised in future courses.
12	Johnston et al. (2010), USA	Aim: Explore the effect of iPod use on the grades of nursing. Theory: Bloom′s taxonomy of learning and social constructivism theory. Setting: Academic. Quality: Medium.	Design: Quasi-experimental comparison pilot study. Data collection: pre and post surveys, weekly user logs and focus groups. Analysis: ANOVA analysis using contrasts, correlations and t-tests, along with descriptive statistics.	Two cohorts of undergraduate nursing students (n = 43) in a third semester medical-surgical course (3 experimental, 1 control & 1 super user group).	Developed: Sony digital PD150 camera used to record lectures. Edited using Final Cut Pro. Content: Medical-surgical lectures were audio-recorded. Duration: 120 min in length. Access: Audio-visual data were compressed to MPEG-4 files for video web streaming. Podcasts given to students on Apple iPods.	The use of iPods tended to be associated with poorer grades. The grades were also poorer with more iPod exposure (p = 0.012). Learning style (visual or verbal/written) and working preference (alone versus collaborate with others) did not moderate the effects of iPods on grades.
13	Kardong-Edgren and Emerson (2010), USA	Aim: Evaluate students use and perceptions of podcasting. Theory: Uses and Gratification Expectancy (UGE) model. Setting: Academic. Quality: Low.	Design: Descriptive study. Data collection: online course survey (16 questions some open ended). Analysis: Zoomerang survey tool calculated percentages.	Undergraduate nursing students (n = 210).	Developed: by faculty. Content: Lectures on 3 courses, pathophysiology and pharmacology, acute and chronic illness in adults and child bearing nursing, audio-recorded. Access: listen to the podcast lecture from their computers or download it to an iPod or MP3 player through Blackboard.	33% of students reported listening to podcasts 1–2 times. 88% of students reported podcasts improved their understanding of material and 77% felt podcasts made a difference in their course grades. 46% used laptops to listen to podcasts. 73% listed to the entire podcast, whereas the remainder listened to them in sections. 17% listened while performing other activities.
14	Kemp et al. (2010), USA	Aim: Examine perceptions of podcasts and relationship to lecture attendance and grade. Theory: Technology Acceptance Model. Setting: Academic. Quality: Low.	Design: not explicitly stated. Data collection: class attendance record and survey used. Analysis: Pearson′s correlation used to analyse survey data.	Convenience sample of second semester undergraduate nursing students (n = 50).	Content: Podcasts of classroom lectures.	36% reported listening to podcasts for 4–5 h per week, with 18% listening for more than 8 h per week. Statistically significant negative relationship between the hours spent listening to podcasts and class attendance n(50) = □ 2.88, p = .043 and final course grade

						n(50) = -2.19, p = .127.
15	Lyons (2013), USA	Aim: Evaluate the impact of digital storytelling on students' reflective thinking in a research course. Theory: None reported. Setting: Academic. Quality: Low.	Design: Comparative study with two groups (no control group). Data collection: questionnaire and anecdotal feedback from students. Analysis: Approach to analysis not described.	Convenience sample of undergraduate nursing students. First study (online forum) n = 19, Second study (podcast) n = 20.	Developed: by faculty, librarian and students. Content: First study - Six online discussion forums about research. Second study - VoiceThread used to develop digital stories of search strategies and research skills. Access: online learning management system.	Students felt engaged with the digital stories and liked the practical application of their colleagues' input. Some students found logging on, navigating and recording stories digitally difficult.
16	McKinney and Page (2009), UK	Aim: Evaluate nursing students' views towards learning pathophysiology via multimedia resources. Theory: None reported. Setting: Academic. Quality: Low.	Design: not explicitly stated. Data collection: Post intervention questionnaires with open ended questions. Analysis: Quantitative data analysed via SPSS. Content analysis was applied to the qualitative data.	Convenience sample of final year undergraduate nursing students (n = 125).	Developed: by faculty. Content: Two lectures from Applied Biomedical Sciences were recorded and made available as a video stream and as a vodcast or podcast. Access: Students accessed material on iPods and MP3 players (n = 35/ 125) and personal computers.	Most students (89%) felt the podcast/vodcast improved their understanding of pharmacology as they could revisit material many times, especially at exam time for revision. The flexibility and convenience of accessing learning resources online appealed to most students. Mobile devices were particularly useful on the move.
17	McSwiggan and Campbell (2017), UK	Aim: explore students' experiences of using podcasts for assessment guidance and feedback. Theory: Bandura's Self-Efficacy Theory. Setting: Academic. Quality: High.	Design: exploratory qualitative pilot study. Data collection: four focus groups. Analysis: framework approach underpinned by the theoretical framework put forward by Self-Efficacy Theory.	Purposive sample of third-year undergraduate nursing students (n = 18).	Developed: by faculty. Content: podcasts to help students understand assessment guidance and feedback in relation to a scenario-based summative examination.	Podcasts appeared to strengthen self-efficacy by providing readily accessible support and by helping students convert intentions into action. Students with high self-efficacy in relation to preparing for assessment were more likely to engage with feedback, whereas those with low self-efficacy tended to overlook opportunities to access feedback due to feelings of

						helplessness and futility.
18	Meade et al. (2009), UK	Aim: evaluate student perception and student use of podcasts of pharmacology lectures and compare exam results. Theory: None reported. Setting: Academic. Quality: Low.	Design: not explicitly stated. Data collection: 21-item survey on patterns and reasons for podcast use and their perceived usefulness as a learning tool. Usage metrics gathered from WebCT. Analysis: SPSS used to analyse frequencies and percentages.	Graduate (post-registration) nurse non-medical prescribing students (n = 30 September 2017 course and n = 39 January 2018 course).	Developed: by faculty and IT services. Content: Audio recordings of live pharmacology lectures, seven in total. Edited using Audacity software. Material divided into bite-size chunks. MP3 format. 2–4 h to produce. Access: streamed via the virtual learning environment WebCT or downloaded to an MP3 player for mobile learning.	Majority (n = 63) accessed at least one podcast. Most students listened to the podcasts on a computer (81%) and 7% downloaded them to a mobile device. Most students listened to podcasts to revisit lecture material or answer a specific question. A minority listened as they missed the lecture. Most students rated podcasts as a very helpful or helpful learning and revision tool to understand pharmacology.
19	Meade et al. (2011), UK	Aim: examine how and why students accessed podcasts, its value for learning, and identify barriers and facilitators to use. Theory: None reported. Setting: Academic. Quality: Medium.	Design: qualitative. Data collection: semi-structured interviews (20–35 min). Analysis: Thematic analysis using template analysis.	Non-medical prescribing graduate nurses (n = 7). Purposive sample of students from high (n = 4), medium (n = 2) and low (n = 1) podcasting use groups.	Developed: by faculty. Content: podcasts of seven pharmacology lectures. Access: through WebCT.	Students used podcasts to revisit pharmacology lectures and understand complex subjects, for revision purposes and exam preparation, or if they missed a lecture. Slow internet connections and not owning a MP3 player or other device prevented use, as did difficulties downloading du
20	Meek et al. (2012), USA	Aim: explore effect of a video podcast on ability to apply health informatics concepts, use the technology and satisfaction with course. Theory: None reported. Setting: Academic. Quality: Medium.	Design: quasi experimental cross-over (8 week) study. Data collection: technology self-assessment and satisfaction survey. Analysis: Statistical analyses such as t tests and a Pearson	Masters nursing students (n = 15) assigned to two groups; one podcast and the second the usual course.	Developed: by faculty. Content: Online lecture, followed by podcast of health informatics competencies, and reflective postings. Access: available via online course environment.	No significant differences in student cognition or engagement scores between the two educational interventions. Course satisfaction was higher for podcasting.

			correlation matrix via SPSS.			
21	Mostyn et al. (2013), UK	Aim: Explore the perceptions of nursing students on biology podcasts for their learning. Theory: none reported. Setting: Academic. Quality: Medium.	Design: Mixed methods study. Data collection: survey on perceived usefulness of podcasts and focus groups. Analysis: Frequencies, means, standard deviations, chi squares, Mann-Whitney *U* test were calculated. Framework technique used for qualitative data.	Convenience sample of 1st year Diploma/BSc (Hons) nursing students (n = 153 survey; n = 6 focus groups).	Developed: by faculty. Content: Nine live biology science lectures were recorded by lecturing staff. Access: Podcasts made available through WebCT.	Most students (59%) accessed the podcasts 1–3 times. Students listened to the podcasts mainly via their computer (70%) or MP3 player (6%). Most students used them to revisit a lecture (73%) or revise subject material (83%) and thought they were a useful learning tool (83%), revision aid (83%) and promoted understanding of material (72%). Difficulties locating and downloading podcasts and poor sound quality of some recorded lectures.
22	Price et al. (2015), USA	Aim: Explore the impact of digital stories in understanding palliative care concepts and what IT elements support this process. Theory: none reported. Setting: Academic: Quality: Low.	Study design: comparative pilot study. Data collection: pilot study - online survey, main study - pre and post intervention survey and online evaluation. Follow up focus groups. Analysis: Content analysis for qualitative data. Quantitative analysis not described.	Fourth year nursing students (n = 66 in pilot; n = 68 in main study).	Developed: by faculty and students. Content: pilot – voice -over Microsoft PowerPoint (PPT) about palliative care (4-person panel of patients and/or families shared personal stories), main study - students used VoiceThread to record content and narration on personal/ professional experiences of palliative care. Access: VoiceThread used to share digital resources.	Students felt they could relate to real live stories, which helped them understand palliative care content and concepts and apply them to practice. Students liked the creativity of digital storytelling as they could put their knowledge and personal experiences together and felt VoiceThread was easy to use.
23	Rogan and San Miguel (2013),	Aim: Evaluate the use of an online terminology tool, podcasts and vodcasts to	Study design: Action research approach. Data collection: evaluation	First year undergraduate nursing students	Developed: by faculty and students. Content: Online terminology tool with 200	The vodcasts were more popular than the podcasts with 34.3% using them. Both resources were used more by the

	Australia	develop clinical communication skills and practice readiness. Theory: none reported. Setting: Academic. Quality: Low.	surveys. Analysis: Descriptive statistics and content analysis.	including English as a second language (ESL) students from China, Korea, Nepal and Vietnam (n = 131 ESL; n = 161 English speaking).	clinical words audio-recorded with associated images (converted to podcast). Six vodcasts of nurses communicating with patients and staff in typical first year scenarios. Access: university website, download to MP3 players and on iTunes.	ESL students than the English-speaking ones. The majority of ESL students felt podcasts and vodcasts helped them be better prepared & confident for clinical placement, especially in pronouncing and spelling words. Students like the convenience of the digital resources for learning but some were unaware of the digital learning resources.
24	Schlairet (2010), USA	Aim: Create podcasts of classroom lectures and explore student outcomes when using these. Theory: web-based learning environments by Billings. Setting: Academic. Quality: Medium.	Study design: not explicitly stated. Data collection: demographic information sheet, opinionnaire on attitude to computers and surveys on podcast use. Analysis: not described in detail, Chronbach′s alpha calculated for the computer opinionnaire.	Three student groups including undergraduate (n = 40), second degree (n = 23) and graduate (n = 7) nursing students (n = 70 in total).	Developed: by faculty. Content: iPod audio player and a universal microphone adapter were used to create the podcast of classroom lectures (n = 133), 82% had accompanying PowerPoint slides. Equipment costs were <$200. Access: course management software via laptop or desktop computer. Duration: average length was 22.5 min.	No significant difference in attitudes towards computers by group before or after using podcasting. 47% of students reported accessing podcasts and no significant differences by group. Undergraduate students listened to podcasts to reinforce learning, second-degree to prepare for exams and graduate to clarify content. 50% of students rated podcasting as helpful for learning.
25	Stiffler et al. (2011), USA	Aim: Compare online reading to a podcast to determine graduate nursing students′ preferences and usage. Theory: none reported. Setting: Academic. Quality: Low.	Study design: pilot study. Data collection: survey to determine access and utility of the podcast. Analysis: not described.	Convenient sample of graduate nurses (n = 17) either clinical nurse specialist or nurse practitioner students.	Developed: by faculty. Content: podcast of a research teaching unit. Access: online course management system and iTunes. Duration: 7-min.	All students listened to the entire podcast. 38% listened to the podcast more than once; 50% three times and 12% four times. Majority (82%) multi-tasked and completed other activities e.g. taking notes while listening to podcast. However, more students found the written material clearer and easier to understand than the podcast.

26	Vogt et al. (2010), USA	Aim: Examine impact of podcasts on student learning and satisfaction. Theory: none reported. Setting: Academic. Quality: Low.	Study design: comparative study of lectures (2007 class) versus podcasts (2008 class). Data collection: MCQ on clinical content and satisfaction survey (2008 cohort only). Analysis: not described in detail but T-tests used.	Junior nursing students enrolled on a child health clinical course. 2007 class (n = 63) and 2008 class (n = 57).	Developed: by faculty. Content: children′s nutritional needs, dental health, sleep requirements, discipline, safety concerns, growth and development, immunizations etc. Access: download to any MP3 player or stream to a computer via the course management system.	Podcasts were listened to in multiple settings. No significant difference between the two groups in their exam results. Although 61% were happy with the podcasting experience, most students preferred traditional lectures and found podcasts less useful for doing homework and quizzes.

Table 2 Participant quotes and author interpretations linked to themes.

Theme 2a: Learning outcomes	
Knowledge	"*Interesting to hear patient's personal views and the effects the condition had upon her*" (Fenton, 2014; Undergraduate nursing students; Participant quote) "*I could go back over the pathophysiology and pharmacology areas that I found most difficult*" (McKinney and Page, 2009; Undergraduate nursing students; Participant quote) "*When I went into the exam, I knew the type of things that I wanted to put down and I wasn't going off on a whole waffle about something else and, even though I was running out of time, I could jot stuff down because I knew from the podcast that these specific things were needed*" (McSwiggan and Campbell, 2017; Third-year nursing students; Participant quote)
Skills	"*Disappointed with communication skills of nurses caring for the patient*" (Fenton, 2014; Undergraduate nursing students; Participant quote) "*Gave the term and said it so you could hear correct pronunciation*" (Rogan and San Miguel, 2013; First-year nursing students; Participant quote) "*… using podcasts to increase awareness that they shared many of same stressors as other students - fatigue, frustration and uncertainty - enabled students to deal with stressors more effectively*" (McSwiggan and Campbell, 2017; Third-year nursing students; Author reporting)
Learned nothing	"*These results suggest that, controlling for students' experience in the course, there were no significant differences between "podcasting" and Course as Usual conditions*" (Meek et al., 2012; Postgraduate nursing students; Author reporting)
Theme 2b: Other outcomes	
Confidence	" …. *midwives reported that following a newborn examination they gained immediate reassurance as they could access the RLOs on the mobile device as an aide memoir, which in turn provided them with reassurance in their own performance*" (Clay, 2011; Midwives; Author reporting) *"I've got confidence a little bit and I'll be able to cope with real clinical situation"* (Rogan and San Miguel, 2013; First-year nursing students; Participant quote)
Theme 2c: Antecedents to learning	
Organisation of social media intervention	"*Although, verbal instructions about podcasting were provided and reinforced, additional written or podcasted instructions may have positively impacted the outcomes*" (Vogt et al., 2010; Junior nursing students; Author interpretation) "*I would have used them earlier had I realised that they were there, or maybe listened if somebody had told me*" (Mostyn et al., 2013; First-year Diploma/BSc (Hons) nursing

	students; Participant quote)
Digital literacy and eProfessionalism	"*Because I wasn't very technically minded it was difficult … and that may be why in the beginning I didn't access them*" (Meade et al., 2011; Graduate nurses; Participant quote) "*Other IT difficulties appeared to stem from some students lack of knowledge or confidence with regard to computers with a small number indicating that they did not know how to download onto an iPod*" (McKinney and Page, 2009; Undergraduate nursing students; Author interpretation)
Personal motivation	"*I just never got around to it …. … It was quite difficult in that it was around Christmas and our exams were just in January ……and that was busy*" (Meade et al., 2011; Graduate nurses; Participant quote) "*There was some suggestion that students with high self-efficacy were more likely to spontaneously engage with the podcasts that were made available to them*" (McSwiggan and Campbell, 2017; Third-year undergraduate nursing students; Author interpretation)
Flexible access	"*I could listen to the lecture on my MP3 player at the same time as doing the housework"* (McKinney and Page, 2009; Undergraduate nursing students; Participant quote) "*I think it's just because you could do it in your own time, and like when you were ready to sit down and do your essay, you could then listen to it once you were ready to start and it was fresh in your head*" (McSwiggan and Campbell, 2017; Third-year nursing students; Participant quote)
Theme 2d: Learning process	
Speed of information exchange	" *… tutorials are vital following online teaching as if you have a problem you can ask for information and it allows us to bounce ideas off each other*" (McKinney and Page, 2009; Undergraduate nursing students; Participant quote)
Social media users	"*I think I learn better from listening so they're quite useful"* (Mostyn et al., 2013; First year nursing students; Participant quote) "*… using a computer is not my preferred way of learning*" (Meade et al., 2009; Graduate nurses; Participant quote) "*I love podcasts! I have attention deficit disorder and historically I have tried to record lectures on my own, but podcast is so much better. It is really hard for me to keep focused during lecture, I think especially as a first semester student. It's all so overwhelming. Listening to the lectures afterwards really helps me*" (Kardong-Edgren and Emerson, 2010; Undergraduate nursing students; Participant quote)
Timeframe	"*Helped me note points I missed during the lab*" (Rogan and San Miguel, 2013; Undergraduate nursing students; Participant quote) "*The podcasts were so great! I could go to class and focus on getting the biggest, most important points and not worry about getting all the details down. This was the first class that I could just sit and listen and really think about the case studies and not just try to write everything down*" (Greenfield 2011; English as a Second Language (ESL) nursing

	students; Participant quote)
Quality of information	"*Easy to understand. sound is very clear*" (Rogan and San Miguel, 2013 ; First year nursing students; Participant quote) "*You know you hear (lecturer's name) say it and it makes sense. It's so clear and it's so easy to understand*" (Meade et al., 2011; Graduate nurses; Participant quote) "*My negative feedback is simply because I was unable to hear the podcast as there was a lot of echoing - I'm sure if I didn't have hearing problems it would have been a very useful tool*" (Meade et al., 2009; Graduate nurses; Participant quote)
Functionality of social media	"*Easy resource to follow*" (Fenton, 2014; Undergraduate nurses; Participant quote) "*Easy to use, I only had average skills and could do it. Loved being able to listen again and again until I understood*" (Mostyn et al., 2013; First year nursing students; Participant quote)
Other learning activities	"*I would listen straight through and then I'd make notes about certain things that I wanted to you know be more specific on and then go back to … look up wherever, computer, books, what have you and then go back to that*" (Meade et al., 2011; Graduate nurses; Participant quote)